

PATENT APPLICATION

RESPONSE UNDER 37 C.F.R. §1.116  
EXPEDITED PROCEDURE  
EXAMINING GROUP 2827



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Keiichi DEN

Application No.: 09/702,870

Filed: November 1, 2000

For: SEMICONDUCTOR DEVICE OF CHIP-ON-CHIP STRUCTURE WITH  
RADIATION NOISE SHIELD (As Amended)

Attorney Docket No.: ROH-0030

Examiner: L. C. Thai

Art Unit: 2827

Confirmation No. 9736

TECHNOLOGY CENTER 2800

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**AMENDMENT AFTER FINAL REJECTION UNDER 37 C.F.R. §1.116**

**BOX AF**

Commissioner for Patents  
Washington, DC 20231

Sir:

In response to the final Office Action dated June 5, 2002, the period for response being extended to October 7, 2002, (October 5 being a Saturday) by the Petition for Extension of Time filed herewith, please amend the above-identified application as follows:

**IN THE CLAIMS:**

Please cancel claims 2 and 3 without prejudice or disclaimer.

Please amend claims 7, 13, 15, 16 and 22-25 as set forth below in clean form. Additionally, in accordance with 37 CFR 1.121(c)(1)(ii), amended claim(s) is/are set forth in a marked-up version in the page(s) attached to this Amendment.

7. (Twice Amended) A semiconductor device comprising:
- a first semiconductor chip;
  - a second semiconductor chip bonded onto the first semiconductor chip in stacked relation;
  - a noise shield film provided between the first semiconductor chip and the

second semiconductor chip for preventing the first and second semiconductor chips from being mutually influenced by noises thereof,

a connection mechanism which connects the noise shield film to a power supply portion, and

a lead frame,

wherein the first semiconductor chip is greater in size than the second semiconductor chip, and the noise shield film is provided on a surface of at least the first semiconductor chip,

wherein a major noise source is present in the second semiconductor chip,

wherein the noise shield film includes a shield portion which covers an area in which the major noise source is present, and an extension portion extending outwardly from the shield portion on a surface of the first semiconductor chip and beyond an edge of the second semiconductor chip,

wherein the connection mechanism includes a bonding wire which directly connects the noise shield film to a portion of the lead frame which has a supply potential or a ground potential.

13. (Twice Amended) A semiconductor device comprising:

a first semiconductor chip;

a second semiconductor chip bonded onto the first semiconductor chip in stacked relation;

a heat conductive member provided between the first semiconductor chip and the second semiconductor chip to define a heat release path for releasing heat generated by the second semiconductor chip; and

a connection member thermally connecting the heat conductive member to a heat radiator, the heat radiator including a heat sink wherein the connection member includes a bonding wire which directly connects the heat conductive member to the heat sink.

15. (Twice Amended) A semiconductor device comprising:
- a first semiconductor chip;
  - a second semiconductor chip bonded onto the first semiconductor chip in stacked relation;
  - a heat conductive member provided between the first semiconductor chip and the second semiconductor chip to define a heat release path for releasing heat generated by the second semiconductor chip; and
  - a connection member thermally connecting the heat conductive member to a heat radiator, wherein the heat conductive member includes a first metal film provided on a surface of the first semiconductor chip and a second metal film provided on the surface of the second semiconductor chip, the first metal film and the second metal film are either in direct contact with each other or directly bonded to each other,
  - wherein a major heat source is present in the second semiconductor chip,
  - wherein the first semiconductor chip is greater in size than the second semiconductor chip,
  - wherein the metal film has an extension portion which extends from the vicinity of the major heat source to a surface portion of the first semiconductor chip not covered with the second semiconductor chip, and the extension portion of the metal film is thermally connected to the heat radiator via the connection member and extends beyond an edge of the second semiconductor chip.
16. (Twice Amended) A semiconductor device comprising:
- a first semiconductor chip;
  - a second semiconductor chip bonded onto the first semiconductor chip in stacked relation;
  - a heat conductive member provided between the first semiconductor chip and the second semiconductor chip to define a heat release path for releasing heat generated by the second semiconductor chip; and
  - a connection member thermally connecting the heat conductive member to a heat radiator,

wherein the heat conductive member includes a first metal film provided on a surface of the first semiconductor chip and a second metal film provided on a surface of the second semiconductor chip, and the first metal film and the second metal film either are disposed in direct contact with each other or are directly bonded to each other,

wherein the first metal film is thermally connected to the heat radiator via the connection member.

22. (Twice Amended) A semiconductor device comprising:

a first semiconductor chip;

a second semiconductor chip bonded onto the first semiconductor chip in stacked relation; and

wherein the first semiconductor chip is greater in size than the second semiconductor chip, and includes a first metal film provided on a surface of the first semiconductor chip, the second semiconductor chip includes a second metal film provided on a surface thereof and the first metal film and the second metal film are either in direct contact with each other or directly bonded to each other,

wherein a major noise source is present in the second semiconductor chip,

wherein the metal film includes a shield portion which covers an area in which the major noise source is present, and an extension portion extending outwardly from the shield portion on a surface of the first semiconductor chip and beyond an edge of the second semiconductor chip

wherein the metal film is provided in a region which covers the major noise source within the second semiconductor chip.

23. (Twice Amended) A semiconductor device comprising:

a first semiconductor chip;

a second semiconductor chip bonded onto the first semiconductor chip in stacked relation;

a metal film provided between the first semiconductor chip and the second semiconductor chip;

a connection member thermally connecting the metal film to a heat radiator including a heat sink; and,

a bonding wire directly bonded to the connection member and connecting the metal film to the heat sink,

wherein the metal film provides a heat release path for releasing heat from a major heat source within the second semiconductor chip.

24. (Twice Amended) A semiconductor device comprising:

a first semiconductor chip;

a second semiconductor chip bonded onto the first semiconductor chip in stacked relation;

a metal film provided between the first semiconductor chip and the second semiconductor chip, the metal film being provided on a surface of at least one of the first semiconductor chip and the second semiconductor chip;

a connection member thermally connecting the metal film to a heat radiator; and

a bonding wire directly bonded to the connection member and connecting the metal film to the heat radiator,

wherein the first semiconductor chip is greater in size than the second semiconductor chip,

wherein the metal film has an extension portion which extends to a surface portion of the first semiconductor chip not covered with the second semiconductor chip, and the extension portion of the metal film extends beyond an edge of the second semiconductor chip,

wherein the metal film is provided in a region which covers a major noise source within the second semiconductor chip, and also provides a heat release path for releasing heat from the major heat source with in the second semiconductor chip.

25. (Twice Amended) A semiconductor device comprising:
- a first semiconductor chip;
  - a second semiconductor chip bonded onto the first semiconductor chip in stacked relation;
  - a metal film provided between the first semiconductor chip and the second semiconductor chip to define a heat release path for releasing heat generated by the second semiconductor chip;
  - a connection member thermally connecting the metal film to a heat radiator; and
  - an electrode portion,
- wherein the metal film includes a first metal film portion provided on a surface of the first semiconductor chip and a second metal film portion provided on a surface of the second semiconductor chip, and the first metal film portion and the second metal film portion are disposed in direct contact with each other or directly bonded to each other,
- wherein the first metal film portion is thermally connected to the heat radiator via the connection member ,
- wherein the electrode portion is provided between the first semiconductor chip and the second semiconductor chip for electrical connection between the first and second semiconductor chips,
- wherein the metal film is composed of the same metal material as the electrode portion.

### **REMARKS**

Claims 4, 5, 7-10, 12-20 and 22-25 are pending in the application. By this Amendment, claims 2 and 3 are canceled without prejudice or disclaimer and claims 7, 13, 15, 16 and 22-25 are amended.

Entry of the Amendment is proper under 37 C.F.R. §1.116 because the Amendment: a) places the application in condition for allowance for the reasons discussed herein; b) does not raise any new issue requiring further search and/or

consideration because the Amendment amplifies issues previously discussed throughout prosecution; c) does not present any additional claims without canceling a corresponding number of finally rejected claims; and d) places the application in better form for appeal, should an Appeal be necessary. The Amendment is necessary and was not earlier presented because it is made in response to arguments raised in the final rejection. The amendments to the subject claims do not incorporate any new subject matter into the claims. Thus, entry of the Amendment is respectfully requested.

Claims 2, 4, 5, 7-10 and 22 are rejected under 35 U.S.C. 103(a) as unpatentable over Yoshida et al. (U.S. Patent No. 5,821,000, 625). The rejection is respectfully traversed.

Yoshida discloses a chip-on-chip structure that has a first semiconductor chip 1 and a second semiconductor chip 5. The first and second semiconductor chips 1 and 5 are joined via a bump 4 which also establishes an electrical connection between the chips 1 and 5. An electro-conductive layer 7 is provided on an insulation layer 8 covering a surface of the second semiconductor chip 5. The electro-conductive layer 7 has an extended area or ground terminal 11, and therefore, the electro-conductive layer 7 can reduce the close talk noise between the chips 1 and 5. The ground terminal 11 of the electro-conductive layer 7 is coupled with an electrode pad 6 on the second semiconductor chip 5. Examples of materials for the bump 4 and the electro-conductive layer 7 include an Sn/Pd two-layer structure film.

Claim 7 is directed to a semiconductor device that includes a noise shield film provided between a first semiconductor chip and a second semiconductor chip, a connection mechanism which connects the noise shield film to a power supply portion and a lead frame. Claim 7 recites that connection mechanism includes a bonding wire which directly connects the noise shield film to a portion of a lead frame which has a supply potential or a ground potential.

It is respectfully submitted that the applied art fails to teach or suggest the features of claim 7. Specifically, the applied art fails to teach a connection mechanism that includes a bonding wire which directly connects the noise shield film to a portion of a lead frame. Thus, one of ordinary skill in the art would not be motivated to modify the



teachings of the applied art because the applied art is devoid of a bonding wire which directly connects the noise shield film to a portion of a lead frame. It is respectfully submitted that, for least these reasons, claim 7 is allowable over the applied art.

Claim 22 is directed to a semiconductor device that includes a first semiconductor chip and a second semiconductor chip. Claim 22 recites that the first semiconductor chip includes a first metal film provided on a surface of the first semiconductor chip and a second semiconductor chip includes a second metal film provided on a surface thereof. Claim 22 recites that the first metal film and a second metal film are either in direct contact with each other or directly bonded to each other.

It is respectfully submitted that the applied art fails to teach or suggest the features of claim 22. Specifically, the applied art fails to teach or suggest a first metal film provided on a surface of a first semiconductor chip and a second metal film provided on a surface of a second semiconductor chip that are either in direct contact with each other or directly bonded to each other. Thus, one of ordinary skill in the art would not be motivated to modify the features of the applied art because the applied art is devoid of these features. Thus, it is respectfully submitted that claim 22 is allowable over the applied art.

Claims 4, 5, and 8-10 depend from claim 7 and include all of the features of claim 7. Thus, the dependent claims are allowable at least for the reason claim 7 is allowable as well as for the features they recite.

Claim 2 is canceled and therefore the rejection as applied to claim 2 is now moot.

Withdrawal of the rejection is respectfully requested.

Claim 3 is rejected under 35 U.S.C. 103(a) as unpatentable over Yoshida in view of Fujimoto et al. (U.S. Patent No. 5,930,599). The rejection is respectfully traversed.

Claim 3 is canceled and therefore the rejection as applied to claim 3 is now moot.

Withdrawal of the rejection is respectfully requested.

Claims 12-16, 19, 20 and 23-24 are rejected under 35 U.S.C. 103(a) as unpatentable over Ohki et al. (U.S. Patent No. 5,886,408). The rejection is respectfully



traversed.

Ohki teaches a semiconductor device that includes a ceramic baseboard, an upper group of semiconductor chips mounted on the ceramic baseboard, heat conductive blocks, a lower group of semiconductor chips mounted on the ceramic baseboard, a resin package for encapsulating the ceramic baseboard, leads which extend from the resin package and a heat sink attached to an upper surface of the resin package.

Claim 13 is directed to a semiconductor device that includes a first semiconductor chip, a second semiconductor chip, a heat conductive member and a connection member thermally connected to the heat conductive member. Claim 13 recites that the connection member includes a bonding wire which directly connects the heat conductive member to a heat sink.

It is respectfully submitted the applied art fails to teach or suggest the features of claim 13. Specifically, the applied art fails to teach a bonding wire which directly connects a heat conductive member to a heat sink. Thus, one of ordinary skill in the art would not be motivated to modify the teachings of the applied art because the applied art is devoid of such features recited in claim 13. It is respectfully submitted that claim 13 is allowable over the applied art.

Claim 15 is directed to a semiconductor device that includes a first semiconductor chip, a second semiconductor chip, a heat conductive member and a connection member thermally connecting the heat conductive member to a heat radiator. Claim 15 recites that the heat conductive member includes a first metal film provided on a surface of the first semiconductor chip and a second metal film provided on a surface of the second semiconductor chip. Further, claim 15 recites that the first metal film and a second metal film are either in direct contact with each other or directly bonded to each other.

It is respectfully submitted that the applied art fails to teach or suggests the features of claim 15. Specifically, the applied art fails to teach a first metal film provided on a surface of a first semiconductor chip and a second metal film provided on a surface of a second semiconductor chip that are either in direct contact with each other

or directly bonded to each other. Thus, one of ordinary skill in the art would not be motivated to modify the teachings of the applied art to arrive at the claimed invention because the applied art is devoid of such features recited in claim 15. It is respectfully submitted that claim 15 is allowable over the applied art.

Claim 16 is directed to a semiconductor device that includes a first semiconductor chip, a second semiconductor chip, a heat conductive member and a connection member. Claim 16 recites that the heat conductive member includes a first metal film provided on a surface of the first semiconductor chip and a second metal film provided on a surface of the second semiconductor chip. Claim 16 recites that the first metal film and a second metal film are either disposed in direct contact with each other or are directly bonded to each other.

It is respectfully submitted that the applied art fails to teach or suggest the features of claim 16. Specifically, the applied art fails to teach a first metal film provided on a surface of the first semiconductor chip and a second metal film a provided on a surface of the second semiconductor chip that are disposed in direct contact with each other or are directly bonded to each other. Thus, one of ordinary skill in the art would not be motivated to modify the teachings of the applied art to arrive at the claimed invention because the applied art is devoid of such features recited in claim 16. It is respectfully submitted that claim 16 is allowable over the applied art.

Claim 23 is directed to a semiconductor device that includes a first semiconductor chip, a second semiconductor chip, a metal film provided between the first and second semiconductor chips, a connection member thermally connecting the metal film to a heat radiator including a heat sink and a bonding wire. Claim 23 recites that the bonding wire is directly bonded to the connection member and connects the metal film to the heat sink.

It is respectfully submitted that the applied art fails to teach or suggests the features of claim 23. Specifically, the applied art fails to teach a bonding wire that is directly bonded to a connection member and connects a metal film to a heat sink. Thus, one of ordinary skill in the art would not be motivated to modify the teachings of the applied art to arrive at the claimed invention because the applied art is devoid of

such features recited in claim 23. It is respectfully submitted that claim 23 is allowable over the applied art.

Claim 24 is directed to a semiconductor device that includes a first semiconductor chip, a second semiconductor chip, a metal film provided between the first and second semiconductor chips, a connection member and a bonding wire. Claim 24 recites that the connection member thermally connects the metal film to a heat radiator. Claim 24 further recites that the bonding wire is directly bonded to the connection member and connects the metal film to the heat radiator.

It is respectfully submitted that the applied art fails to teach or suggest the features of claim 24. Specifically, the applied art fails to teach a bonding wire that is directly bonded to a connection member and connects a metal film to a heat radiator. Thus, one of ordinary skill in the art would not be motivated to modify the teachings of the applied art to arrive at the claimed invention because the applied art is devoid of such features recited in claim 24. It is respectfully submitted that claim 24 is allowable over the applied art.

Claim 12 depends from claim 15 and includes all of the features of claim 15. Claims 14, 17, 19 and 20 depend from claim 13 and include all of the features of claim 13. It is respectfully submitted that the dependent claims are allowable at least for the reasons the independent claims are allowable as well as for the features they recite.

Withdrawal of the rejection is respectfully requested.

Claims 17, 18 and 25 are rejected under 35 U.S.C. 103(a) as unpatentable over Ohki in view of Byun (U.S. Patent No. 5,668,040). The rejection is respectfully traversed.

Byun teaches a semiconductor device electrode which serves as a diffusion barrier.

Claim 25 is directed to a semiconductor device that includes a first semiconductor chip, a second semiconductor chip, a metal film provided between the first and second semiconductor chips, a connection member thermally connecting the metal film to a heat radiator and an electrode portion. Claim 25 recites that the metal film includes a first metal film portion provided on a surface of the first semiconductor

chip and a second metal film portion provided on a surface of the second semiconductor chip. Also, claim 25 recites that the first metal portion and a second metal portion are disposed in direct contact with each other or directly bonded to each other.

It is respectfully submitted the applied art fails to teach or suggest the features of claim 25. Specifically, the applied art fails to teach or suggest a first metal film portion provided on a surface of the first semiconductor chip and a second metal film portion provided on a surface of the second semiconductor chip that are disposed in direct contact with each other or directly bonded to each other. Thus, one of ordinary skill in the art would not be motivated to combine the teachings of the applied art because such combination would not result in the claimed invention. It is respectfully submitted that claim 25 is allowable over the applied art.

Claims 17 and 18 depend from claim 13 and include all of the features of claim 13 which, as discussed above, is allowable over the applied art. Thus, the dependent claims are allowable at least for the reasons claim 13 is allowable as well as for the features they recite.

Withdrawal of the rejection is respectfully requested.

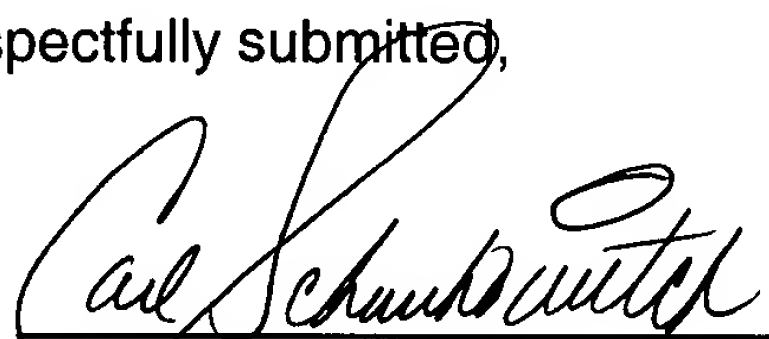
In view of the foregoing, reconsideration of the application and allowance of the pending claims are respectfully requested. Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' representative at the telephone number listed below.

Should additional fees be necessary in connection with the filing of this paper or if a Petition for Extension of Time is required for timely acceptance of the same, the Commissioner is hereby authorized to charge Deposit Account No. 18-0013 for any such fees and Applicant(s) hereby petition for such extension of time.

Respectfully submitted,

Date: October 7, 2002

By:

  
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Enclosure(s):      Appendix I (Marked-Up Version of Amended Claims)  
                              Petition for Extension of Time (One Month)

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